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REDESIGNING ALGEBRA COURSES: FROM IMPLEMENTATION TO RESULTS

Laura J. Iossi
Broward College
Department of Mathematics, Broward College, 3501 S.W. Davie Rd. Davie, Fl 33314.
liossi@broward.edu

Nationally, less than 10% of students who begin at a remedial level graduate within three years (Complete College America, 2012). At Broward College, 55% of incoming students test into developmental mathematics courses. Only 43% of those students that enroll in developmental mathematics complete developmental mathematics within two years. Out of about 8,000 new students in fall term of 2012, two-thirds began in math prep with almost 30% in the lowest level. The college had thousands of students that were entering developmental mathematics courses and thousands that were neither completing their remedial math courses nor graduating. The college-wide mathematics department wanted to change this trend.

In addition to the challenge of successful completion of students' mathematical course of study, the college had the administrative challenge of overseeing hundreds of Algebra courses each year. Another drive behind the redesign was a desire to provide more guidance for adjuncts. With over 100 math adjuncts college-wide each semester, it was necessary that more quality control be introduced. The courses needed some sort of standardization to ensure that every student received instruction on all the state competencies as well as on all the topics in the college course outlines. In 2008, faculty and deans met and discussed how to best accomplish this.

The underlying principle that guided the faculty is simple: Students learn math by doing math, not by listening to someone talk about doing math. Students are digital consumers and multi-taskers with brief attention spans. In the age of text messages and social media, students are used to receiving information in little snippets and sound bites. Our faculty wanted to address these characteristics of our students. Faculty attended conferences, visited other colleges to learn about various redesign and/or emporium models of instruction and concluded that students learn by doing and work better collaboratively. Interactive computer software combined with personalized, on-demand assistance and mandatory student participation were determined to be the key elements of success. So, these ideas guided the transformation of math courses at Broward College.

The Setting

Broward College

Broward College is a community college with an annual enrollment of over 67,000. The college offers Associates degrees, certificate programs, and a handful of Bachelor's degrees. It is located in urban South Florida spread out over three campuses and a handful of satellite centers. Broward College boasts a diverse student body in ethnicity, race, age, and socioeconomic status.

Courses

Eventually, Broward College adopted the redesign model for the three courses in the math pathway and college algebra. Among the redesigned courses are two developmental math courses, Developmental Mathematics I (formerly Pre-Algebra) and Developmental Mathematics II (formerly Beginning Algebra). These courses are three credits each with an accompanying one credit lab course. The class size for these courses is capped at 30 students. The college also offers redesigned formats for the gateway course, Intermediate Algebra, and for College Algebra which are each capped at 40 students.

Implementation

Course Format

The additional goal of acceleration became part of the discussion. Thus, most of the redesign courses have been in a "fast track" format. This means that students could complete each course in 8 weeks. The class would meet for 75 minutes on Mondays through Thursdays.

Class Format

New material is presented with a series of about 5 – 7 videos that range from 1 – 4 minutes each for a total of approximately 20 – 25 minutes of video time. Faculty may pause the videos at any time and interject comments. Additionally, faculty may intersperse their own material and examples between videos. Professors encourage students to ask questions and write notes about the material from the videos and instructors. Ultimately, the instructional component of the class takes up about 40 minutes of class. For approximately the last 25 minutes of class, students work on class worksheets. Class announcements, returning previous worksheets, and answering questions about HW and the returned worksheets fill up the remaining 10 – 15 minutes. Note that the majority of classes were not in computerized classrooms. However, each classroom contained a teacher presentation station with a computer with internet access and a projector with sound.

Grading Policy

The grading policy is uniform across sections and is based on four categories: ALEKS, classwork, tests, and the final exam. In ALEKS students are expected to complete eight Intermediate Objectives. Completion of each Intermediate Objective by its specified due date is worth a total of 200 points (25 points per Intermediate Objective). The required class worksheets based on new material taught in class is worth 100 points. There are about 24 class worksheets that must be submitted by the end of class on the day they were assigned. The highest 20 scores on the in-class worksheets count towards the class work grade and are worth 5 points each. Each of four in class tests is cumulative and is worth 90 points for a total of 360 points. Lastly, the cumulative departmental final exam is worth 140 points. Note that students have to pass the final exam to pass the course in Developmental Math II.

Course Management System

The institution utilizes Desire to Learn (D2L) as the course management system. Typically, for classes that meet face to face, most instructors post syllabi and important announcements, and communicate via email on D2L. However, the math redesign courses utilize D2L in a much more significant fashion. The redesign shell contains both material for the students and additional material for instructors' eyes only.

For instance, the MAT 0028 D2L shell contains eleven modules for students: orientation and syllabus, one for each of the eight intermediate learning objectives in ALEKS, final exam, and student resources. The orientation contains eight links: a tutorial video on navigating D2L, an instructor contact information sheet, a syllabus, the daily course schedule, an orientation to ALEKS, ALEKS registration instructions, a link that directs students directly to the registration, and a formulas and procedures document (see Appendix B for sample orientation material). The eight intermediate course objectives within ALEKS are listed with the corresponding days of classes of the semester (e.g. Objective 1: Days 1 and 2). Each day contains four subheadings. Once you enter one of the objectives and then select the day, the first document is an overview of the "day." This includes the topics that will be covered organized according to ALEKS topics, the titles of the videos that will be shown in class, and the corresponding pieces of the pie that students should work on in ALEKS (see Appendix A for sample daily overview). Next, the students have access to the links of the videos that are shown in class. The third item contains the skeletal notes for the day. The last item is the direct link into the ALEKS course. This pattern of material occurs for each of the 28 days of class, with the exception of test days. On test days, a document that reminds students what to bring to the test along with test taking tips is included. The final exam exam module contains two items: a 90 question final exam review and a web based electronic final exam review. Finally, the student resources module contains a link to ALEKS customer support, a link to ADOBE reader download (some documents are PDF files), a link to our learning resource center, and the college course outline which contains the material that is covered in the course college-wide.

The above material is the basic material that is given to all instructors to share with their students. However, instructors are free to add their own material. For instance, I added a link to a virtual classroom (WIMBA) so that I may help students more easily.

There is additional information that is only visible for instructors on D2L. There is an additional orientation module for professors. Within this module, there is a document with instructor guidelines that provides a description of the key components of the redesign course. Next, there is a powerpoint that explains the need for redesign and the philosophy of our redesign. The last three links in the instructor orientation contain instructions on how to link the D2L course to ALEKS, how to set up the ALEKS gradebook, and the link that directly joins ALEKS and D2L.

Within the modules that contain the day to day material, instructors have access to two versions of the class worksheets, one for projecting that fits on one screen and another for copying should the instructor elect to provide student handouts (see Appendix C for a

sample day's links on D2L). Finally, instructors are provided with six versions of each test, four of which are multiple choice and two are free response. Keys for these tests are also supplied.

Adaptive Homework Tool

The course redesign incorporates ALEKS as the homework management system. ALEKS uses initial and subsequent assessments to determine a study plan for students. There are eight intermediate objectives (for a total of 206 topics) within ALEKS. Each in class test incorporates two new learning objectives. For instance, the third test focuses on material from objectives 5 and 6, but contains some cumulative questions from learning objectives 1 – 4.

Faculty Support

As the college began implementing redesign, getting the word out was an initial obstacle. Faculty were resistant to such radical change, especially since initial results were mixed. Tweaking and altering the redesign components to best fit the college is a key component to success. Faculty training was incorporated into the plan. Redesign faculty conducted workshops on each campus to inform and train faculty as part of professional development. Redesign professors became mentors to fledgling redesign faculty. Redesign course developers listened to the reservations of faculty and revised the redesign to include more options to satisfy varying teaching preferences (e.g. tests were offered in both multiple choice and free response formats).

Results

From Fall of 2010 to Winter of 2012, Broward college has offered 152 redesigned sections with 4,022 students enrolled in these sections. As Table 1 indicates, overall there have been significantly higher passing rates ($p < .01$) and significantly lower withdrawal rates ($p < .01$) in the redesigned sections as compared to the non-redesigned sections.

Table 1

Student Success and Withdrawal by Course Type for Fall 2009 through Winter 2012.

Course Type	Number of Course Sections	Number of Students Enrolled	% of Students with A, B, or C	% of Students Withdrawing
Redesigned	152	4022	53%	12%
Non-Redesigned	2562	78613	50%	16%

Furthermore, as Figure 1 illustrates, last academic year (2011-2012) there were significantly higher passing rates ($p < .01$) in the redesign sections for each of the preparatory Algebra courses.

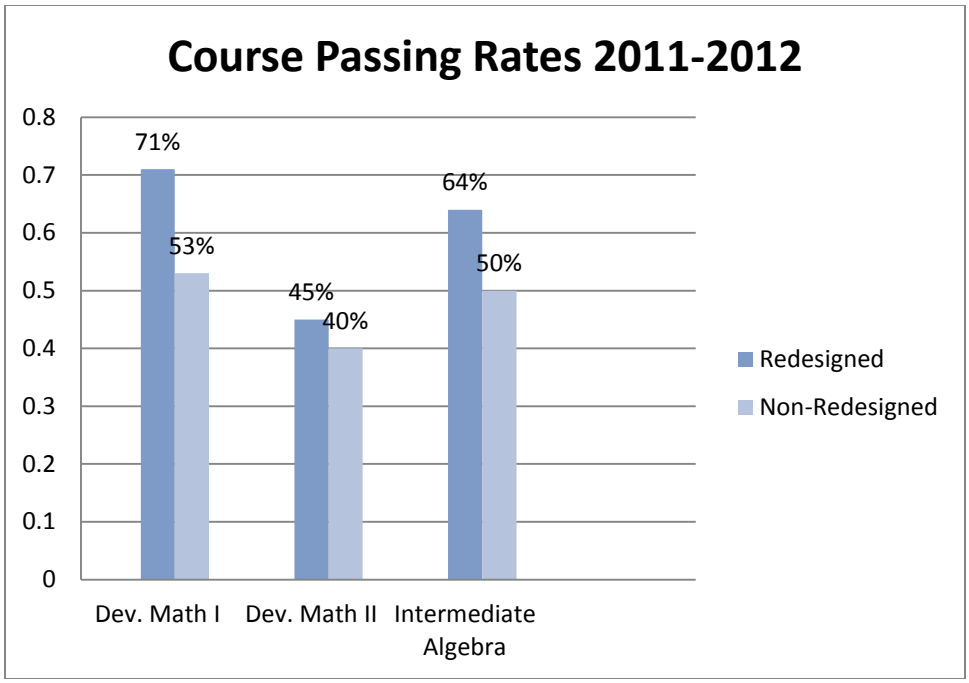

Figure 1. Course passing rates for redesigned and non-redesign preparatory math courses for 2011 – 2012.

Data from our most recent semester indicates that we have significantly higher pass rates ($p < .01$) in our math redesign courses for all of our preparatory math course offerings once again (see Table 2).

Table 2
Student Success Percentages by Course Type for Fall 2012

Course Type	MAT 0018	MAT 0028	MAT 1033	% of Students Withdrawing
Redesigned	68%	48%	67%	12%
Non-Redesigned	59%	41%	55%	16%

For the last few semesters, the redesign has consistently been providing a more successful learning environment for students.

Conclusion

Algebra redesign at Broward College has resulted in improved success rates for our students. For the future, the success data has to be broken down according to student demographics. The college needs to assess whether the redesign format is indeed more successful for various demographics such as race, ethnicity, gender, age, and socioeconomic status. Some indication whether this format levels the achievement gap must be looked into.

Further research should study which of the variables are contributing to student success in these redesigned courses. Possible contributing variables include the eight week format, the class meeting four days a week, the electronic homework, the graded worksheets, the videos, the standardized courses, and the standardized tests.

Other forms of redesigned courses are currently being piloted at the college. Although those success rates are currently low, they could change once the initial learning curve is surpassed. Soon, we may have data on what is the best redesign out of our redesigns. Eventually, a diagnostic may be necessary to pair students with the redesign format that best meets their needs.

We have redesigned courses available for the entire algebra sequence including Developmental Math I and II, Intermediate Algebra and College Algebra. Future plans include increasing the number of sections of redesigned courses across the college. One campus offers a lower ratio of redesign courses to non-redesign courses than the other campuses, and we are hoping to increase that as well. Future plans include a similar redesign offering for our emerging developmental statistics course and the successive college level statistics course. Of course, the success of these redesigned math courses is having a ripple effect across our college. Other departments are considering adopting some form of redesign especially in other developmental education areas.

Reference

Complete College America. (2012). *Remediation: Higher Education's Bridge to Nowhere*. Retrieved from http://www.completecollege.org/docs/CCA-Remediation-summary.pdf.

Appendix A
Sample Day 12 Overview

Day/ Date	Int . Obj	Topics to be covered (Homework)	Activities & Assessments
Day 12	**4**	**"My Pie" Section: Functions, Lines, and Systems of Equations** • Finding slope using the slope formula • Graphing a line through a given point with a given slope • Use the slope to determine additional points on the graphs of lines (not in ALEKS, not a video) • Finding the slope of a line given its equation	**In class:** • Watch the following videos: ○ 3.3.3.Introduction to the Slope Formula (3:51 min) ○ 3.3.4.Using the Slope Formula (1:36 min) ○ 3.3.6.Determining the Slope of a Vertical Line (1:17 min) ○ 3.3.7.Determining the Slope of a Horizontal Line (1:40 min) ○ 3.3.8.Estimating the Slope of a Line from the Graph of the Line (1:42 min) ○ 3.4.1.Introduction to Slope-Intercept Form (2:53 min) ○ 3.4.2.Introduction to Slope-Intercept Form (3:55 min) (Show definition only) ○ 3.4.3.Graphing a Line From its Slope and y-Intercept (1:13 min) • Read and review the file: "Use the slope to determine additional points on the graphs of lines" • Complete and submit **Class Work 12** **Outside of class:** • Complete My Pie section **Functions, Lines, and Systems of Equations** in ALEKS.

Appendix B
Orientation Material in D2L

Content Items	Actions
MAT0028 DEV MATH II ENHANCED 449109	
Instructor Orientation	
i. Instruction Guidelines	
ii. Course Redesign Presentation	
iii. How to link your ALEKS course to your BConline course	
iv. Aleks Grade book Set Up	
v. Link your ALEKS course to your BConline course HERE	
ALEKS Login	
i. ALEKS Login	
Course Orientation and Syllabus	
i. Basic Navigation in BConline	
ii. Course and Instructor Information	
iii. Syllabus MAT0028	
iv. Course Schedule	
v. Orientation to ALEKS	
vi. Purchase a 9-week Access Code	
vii. ALEKS Registration Instructions	
viii. Register for ALEKS	
ix. Formulas and Procedures MAT0028	

Appendix C
Sample D2L Day